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Kenney

[11] **3,712,762**
[45] **Jan. 23, 1973**

[54] **CONCRETE PUMP**

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[73] Assignee: **Arthur Hansmann,** Racine, Wis. ; a part interest

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[52] **U.S. Cl.**...................................**417/477,** 417/900
[51] **Int. Cl.**.....**F04b 15/02,** F04b 43/08, F04b 43/12
[58] **Field of Search**......417/476, 477, 900, 474, 475, 417/46, 454

[56] **References Cited**

UNITED STATES PATENTS

2,466,618	4/1949	Stocks	417/475 X
2,935,028	5/1966	Ferrari et al.	417/477 X

FOREIGN PATENTS OR APPLICATIONS

804,536	11/1958	Great Britain	417/477

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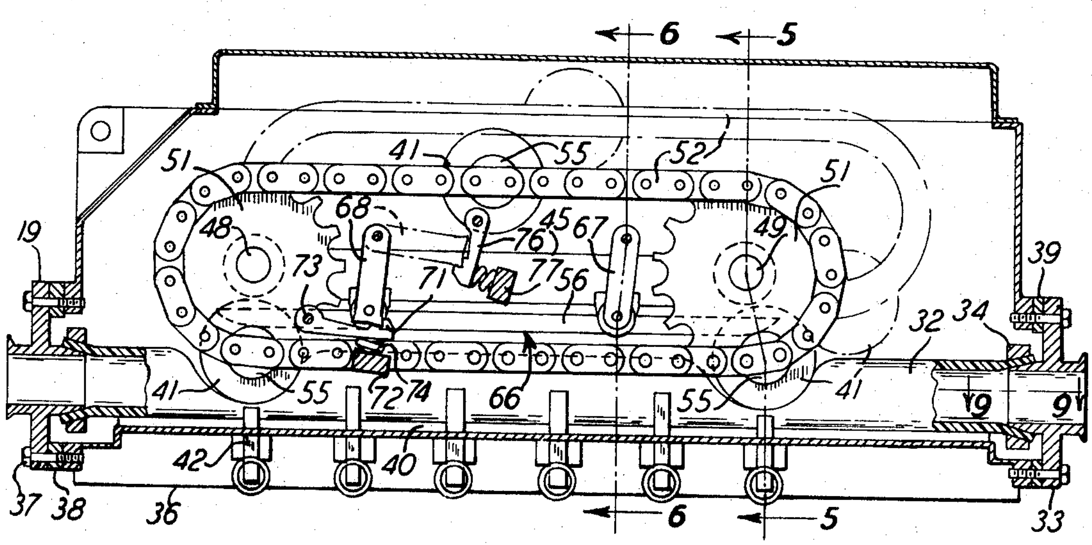
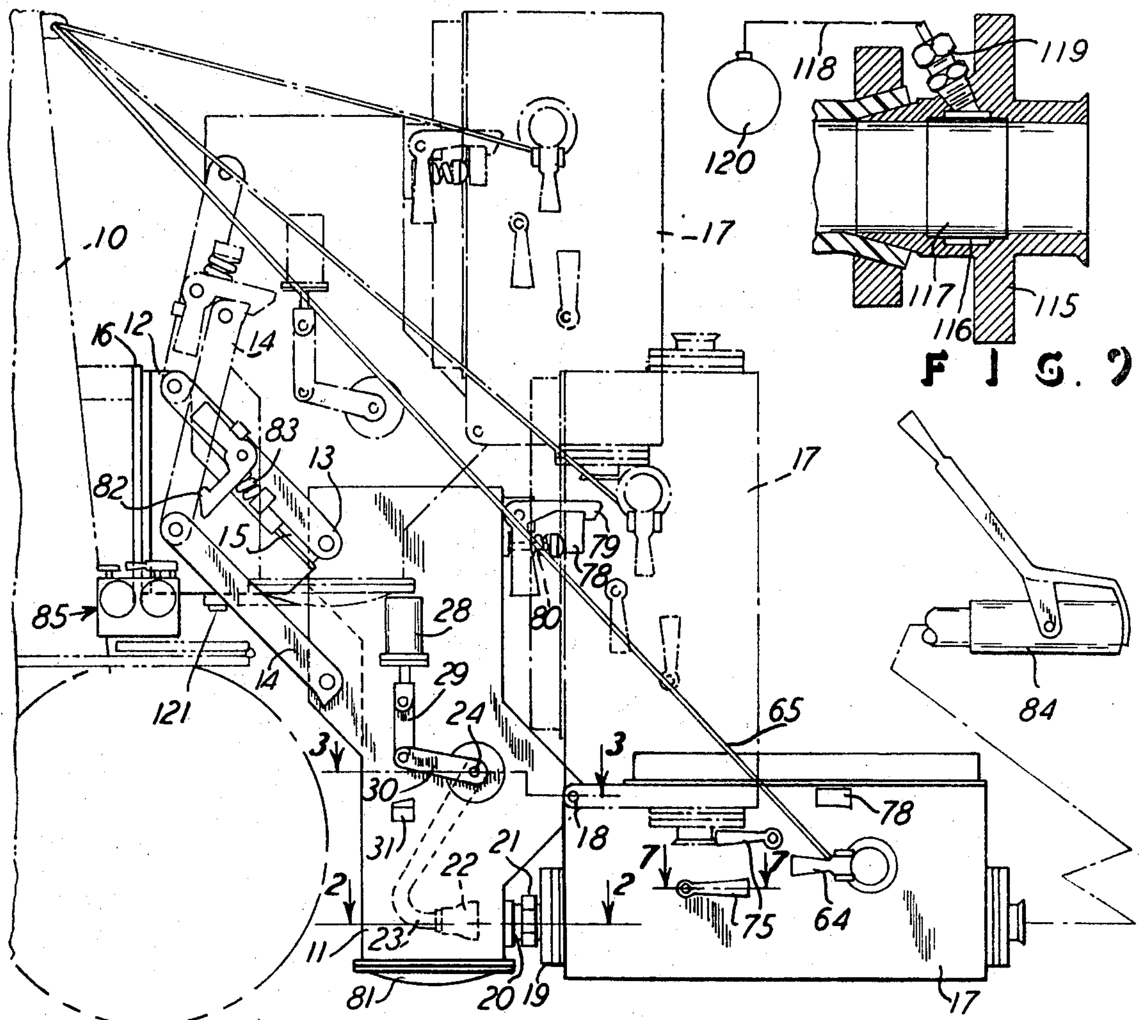
[57] **ABSTRACT**

A concrete pump having an elongated flexible hose for receiving the concrete, and having rollers which run along the hose to squeeze the hose and thereby pump the concrete through the hose. The hose is disposed in a straight condition, and the rollers are moved along by a chain, and a guide rail positions the rollers against the hose for the squeezing of the hose and the consequent pumping of the concrete through the hose. A gravity-feed hopper with a reciprocating piston fills the hose for charging it with the concrete. Spring-biased fingers assist the hose in regaining its tubular shape after it has been squeezed by the rollers.

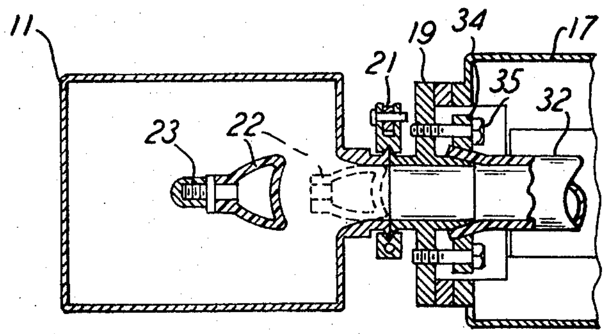
5 Claims, 9 Drawing Figures





F I G. 1

F I G. 9



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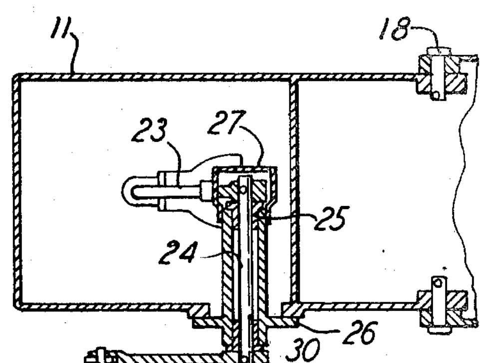

F I G. 3

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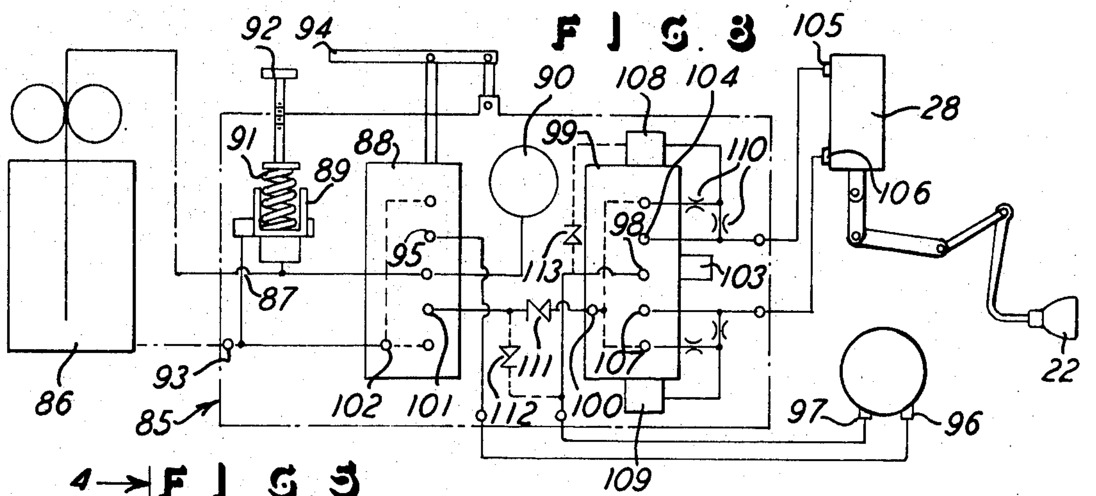

FIG. 8

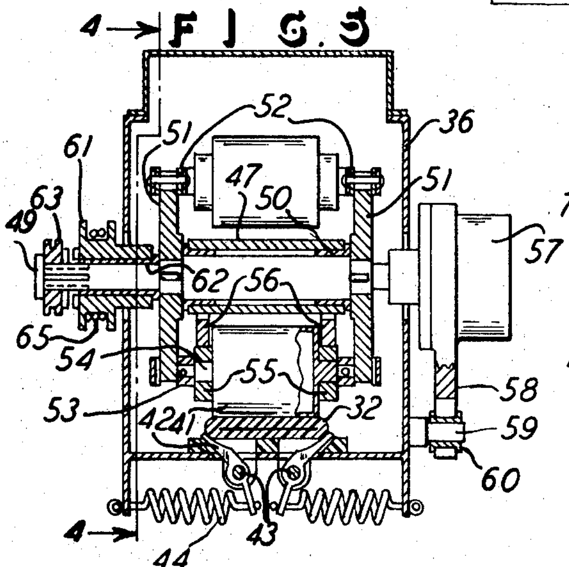

FIG. 5

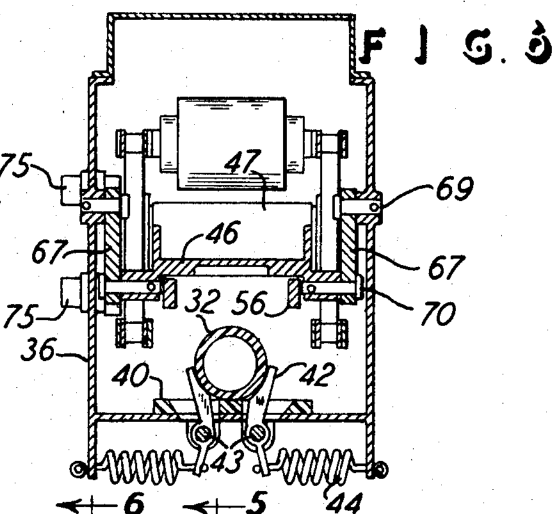

FIG. 6

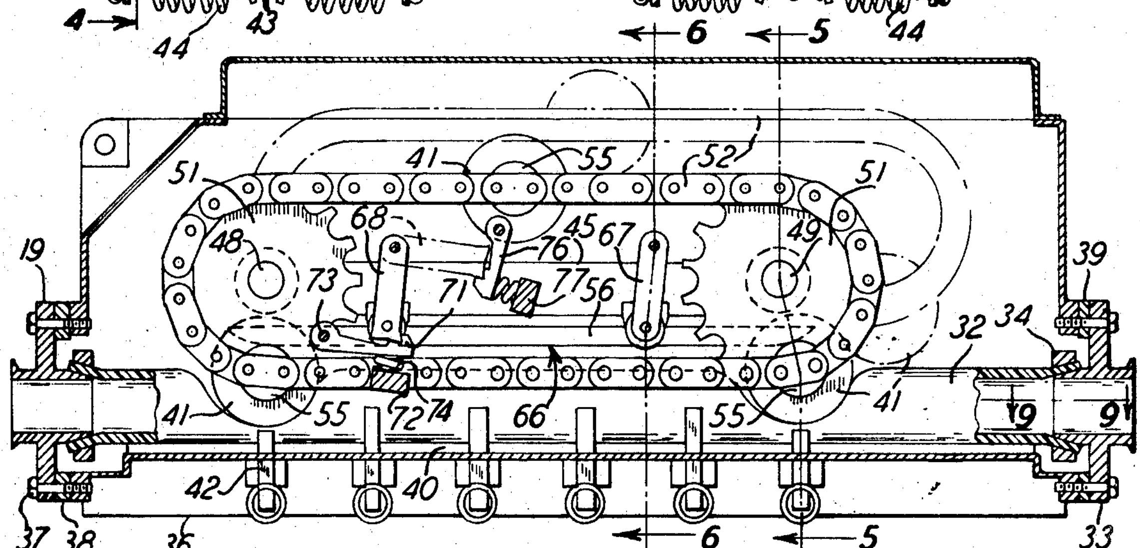

FIG. 4

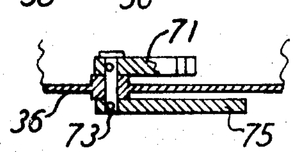

FIG. 7

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CONCRETE PUMP

This invention relates to a concrete pump of the type utilized in pumping concrete from a delivery truck, or the like, to a job-site location.

BACKGROUND OF THE INVENTION

Presently available concrete pumps utilize flexible hoses which are filled with concrete and are squeezed for forcing the concrete through and from the hose and to the desirable location of the job site. These prior art pumps commonly employ rollers which advance along the length of the hose for squeezing the hose and performing the pumping action. One example of a roller type of pump is found in U.S. Pat. No. 3,180,272. Also, prior art pumps are known to have straight sections of flexible hose, rather than a coiled or curved section such as shown in the cited patent, and U.S. Pat. No. 2,546,852 shows one example of a straight hose. In the latter patent, the hose is squeezed by means other than rollers which run along the hose.

The prior art pumps are concerned with the problems of re-shaping the flexible hose after it has been squeezed so that the hose can regain its tubular shape and thereby be open to readily receive a new charge of concrete. Also, where the prior art pumps have coiled or curved sections, there is the problem of obtaining optimum flow of the concrete through the curved section which inherently provides the greatest resistence to the flow of the concrete.

Accordingly, in view of the aforementioned problems, the present invention is intended to overcome these problems and to thereby provide a concrete pump which is of maximum efficiency. Further, the present invention accomplishes this object while utilizing a small and lightweight and inexpensive structure so that the pump can be employed in a variety of stationary and also a variety of mobile installations. That is, the pump of this invention can be employed in conjunction with a mobile concrete delivery truck or mixer, and, in fact, the pump of this invention can be mounted directly on the mobile unit itself.

A more specific object of this invention is to provide a concrete pump which employs a straight flexible hose, rather than a curved flexible hose, and the hose is collapsed for the pumping action and by means of advancing rollers, and, further, the hose is re-positioned to its extended shape in a simplified and improved manner, all compared to the prior art.

Still another object of this invention is to provide a concrete pump which is susceptible to full and complete control of the operator, both for the purpose of positioning the entire structure for operation and repositioning it for in-operative and transport position, as well as arranging the pump for immediate detection and signaling as to when the pump may be overloaded or clogged. In this manner, the present invention provides means through which the operator can constantly monitor and be informed as to the operation of the pump, and, means are also provided for clearing the pump of the obstruction or cause of delay so that the pump can function at optimum efficiency and with minimum interruption.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a pump of this invention and showing it related to a mobile concrete mixer, shown in dot-dash lines, and also showing the pump unit in two raised and inoperative positions, as shown in dot-dash lines.

FIG. 2 is an enlarged sectional view taken on the line 2—2 of FIG. 1.

FIG. 3 is an enlarged sectional view taken on the line 3—3 of FIG. 1.

FIG. 4 is an enlarged sectional view from the side of the pump as shown in FIG. 1 and with the view being taken along the line 4—4 of FIG. 5.

FIGS. 5 and 6 are sectional views taken along the lines 5—5 and 6—6, respectively, of FIG. 4.

FIG. 7 is an enlarged sectional view taken along the line 7—7 of FIG. 1.

FIG. 8 is a schematic diagram of the control system for the pump.

FIG. 9 is an enlarged sectional view taken along the line 9—9 of FIG. 4, with parts added thereto.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows the pump of this invention attached to the rear end of a mobile concrete mixer, such as a concrete truck, part of which is shown in dot-dash lines designated **10**. The pump and its mounting members are shown in full lines in the operating position, and it is also shown in dot-dash lines which indicate the pump cleaning position, and the uppermost dot-dash lines showing the pump indicate the pump transport position, all relative to the support unit **10**.

The pump has a feed tank **11** which is suspended from a support bracket **12** by two pair of pivoted links **13** and **14**. A cushioned adjustable stop **15** is supported on the mounting bracket **12** and engages the two links **13**, only one of which is shown but it is understood that the links **13** and **14** provide a parallelogram type of link mounting. The stop **15** thereby serves to establish the operating position of the pump, as shown in the full lines in FIG. 1. The support bracket **12** is suitably attached to a mounting plate **16** which in turn is attached to the unit **10**, all in any conventional manner such as by bolting or welding, and thus the pump can be affixed to and removed from the unit **10**, as desired. The drawings also show that the tank **11** is deep so that it can provide a gravity head of concrete at the tank outlet connection near the bottom of the tank. Thus the upper end of the tank **11** is opened and receives the concrete from the unit **10**, in any usual manner of delivery from a mixer truck or whatever the unit **10** may be.

The concrete pump proper is indicated at **17** and is shown in full lines to be suitably connected to the tank **11**. Thus, two pivot pins, such as the shown pin **18**, pivotally attach the pump **17** to the tank **11** so that the pump can be supported on the tank **11** and swing from the horizontal position shown in full lines and up to the vertical position shown in the dot-dash lines in FIG. 1. The pump unit **17** has an inlet fitting **19** which connects to the tank outlet fitting **20**, and these two fittings are held together by a bolted type coupler **21**. Thus, concrete from the tank **11** is fed to the pump **17**, in a manner hereinafter more fully described and with the concrete moving through the fittings **19** and **20**.

A flexible charging piston **22** is movably mounted in the tank **11** by a support arm **23** which swings about a shaft **24** mounted on the tank **11**. FIG. **2** shows the piston plunger **22** in the retracted position, in full lines, and it shows the plunger in the advanced and full pumping position, in dotted lines. That is, in the full pumping position, the plunger **22** enters the outlet opening for tank **11**, and the plunger **22** thereby advances the concrete through the mating openings of the tank **11** and the pump unit **17**.

FIG. 3 shows that the plunger arm **23** is supported on the shaft **24** which is rotatable in the bearings **25** spaced apart in support bracket **26** mounted on the tank **11**. A flexible protective boot **27** covers the connecting joint between the shaft **24** and the arm **23** to protect the mounting arrangement from the concrete in which it is immersed.

FIG. 1 shows that the shaft **24** is powered by a hydraulic cylinder **28**, or like conventional means, which is connected to the shaft **24** by means of a link **29** and an arm **30** which is pinned to the shaft **24**, as seen in FIG. 3. An adjustable stop may be provided for adjusting the stroke of the plunger **22**, and such stop is indicated at **31** and is available for engaging the arm **30** to limit the stroke.

Having thus charged the pump unit **17** with concrete, by means of the charging mechanism described, such as the plunger **22**, the pump itself then operates to move the concrete through the pump and to the ultimate discharge at the job site. The pump structure and operation are disclosed in FIGS. **4**, **5**, and **6** where it will be seen that a flexible hose **32** is suitably connected to the pump inlet or passageway which receives the concrete from the supply tank **11**. The hose **32** is shown to be tubular and straight and extends through the length of the pump unit itself. Thus, at the pump inlet end, the hose **32** connects to the shown tapered portion of the fitting **19**, and, at the outlet end of the pump, the hose **32** similarly connects to a tapered end of a fitting **33**. The hose is held to these fittings by clamp rings **34** and bolts **35**, such as seen in FIG. 2. The pump unit **17** has its frame **36** connected, by means of bolts **37**, to the fitting **19** and with an intervening spacer **38**. The spacer **38** is adjustable to permit the pump to be square with the tank **11** and thereby have the fitting parallel with the tank outlet fitting **20**. Similarly, the outlet fitting **33** is bolted to the pump frame **36**, and a spacer **39** is used for holding the hose **32** taut between the inlet and outlet ends of the pump unit **17**.

The drawings also show that a strip of cushion or resilient material **40** is disposed below the hose **32** and rests on the floor of the frame **36** for further supporting and protecting the hose **32**.

FIG. 4 shows that the pump unit has three rollers **41**, and the two rollers **41** are shown in operative position of compressing the hose **32**. Fingers **42** are pivotally mounted on the frame **36** and are in contact with the hose **32**, and the fingers **42** are mounted on pivot pins **43** and are under influence of tension springs **44**. Thus, as seen in FIG. 6, when the rollers **41** are not in position to pivot the fingers **42** downwardly, as shown in FIG. 5, then the fingers **42** will be pivoted upwardly, under the influence of springs **44**, and the fingers **42** will thereby position the hose **32** in its open or tubular position shown in FIG. 6.

The pump unit includes a roller assembly frame **45** which has a channel **46** and two cylinders **47**, all being connected together to support shafts **48** and **49** in bearings **50**. Sprockets **51** are mounted on the shafts **48** and **49**, and a roller chain **52** is trained on the sprockets **51**. The rollers **41** are rotatably connected on the chain **52** by mounting on plates **53** on the chain **52** and by having trunnions **54** on the rollers **41** extend into connection with the chain plates **53**. Wheels **55** are journaled on the trunnions **54** to roll along guide rails **56** supported on the roller frame **45** to thereby hold the rollers **41** downwardly into the hose **32**. Thus, as seen in FIG. **4**, the chain **52** will be powered in the counterclockwise direction, and the rollers **41** will than move from left to right along the straight length of the hose **32** to pump the concrete through and from the hose **32**.

FIG. 5 shows a hydraulic motor **57** having slotted arm **58** extending therefrom and being anchored on a pin **59** carrying a bushing **60**. The motor **57** is coupled to the shaft **49** which also connects to a cable drum **61** supported on a bearing **62** on the shaft **49**. A clutch **63** is splined onto the shaft **49** so that it can move axially to engage and rotate the drum **61**, and the clutch **63** is under the influence of a lever **64**, as seen in FIG. **1**, for axial displacement of the clutch **63**. Thus, operation of the motor **57** and actuation of lever **64** will cause cable **65** to wind up onto drum **61** and thereby pivot the pump unit **17** about the pins **18** and thereby raise the unit **17** to the dot-dash intermediate position shown in FIG. **1** to render it inoperative.

The pump roller assembly, generally indicated **66**, is suspended from the frame **36** by four pivoted links, three of which are links **67** and the fourth of which is a link **68** of a special end configuration. Thus mounting pins **69** connect the links to the frame **36**, and mounting pins **70** connect the links to the roller assembly **66**. With the assembly in the downward position, the pump assembly is in the operative position, and the special end of link **68** is engaged by a securing latch **71** which is backed up by a stop **72** and which is pivoted on a pin **73**. A compression spring **74** operates between the stop **72** and the latch **71** to position the latter for automatic latching with the link **68**. Shaft **73** has a lever **75**, as seen in FIG. 7, and the lever **75** is located outside the pump frame **36** to permit manual release of the latch **71**. Thus, when latch **71** is released and cable drum **61** is engaged and rotated, the roller assembly will swing upward into the dot-dash line position shown in FIG. **4** to remove the rollers **41** from the hose **32**. Continued wind-up of the cable **65** will further raise the entire pump unit, and it will be seen that the shaft **49** and drum **61** and motor **57** have sufficient clearance relative to the frame **36** for movement of the pump assembly from the solid line to the dot-dash line position, as described and relative to that frame **36**. In releasing the pump assembly **66** as described, link **68** is moved to the dot-dash line position shown and it then engages a latch **76** which operates against a stop **77** and having the shown spring in abutment with the latch **76** for automatic engagement with the link **68** and thereby hold the assembly in the upper inoperative position. Also, latch **76** is then under the influence of a lever on the outside of the frame **36**, such as described in connection with the latch **71** and lever **75**.

Referring again to FIG. 1, the pump unit **17** is then swung into the intermediate dot-dash line position shown, and a fixed lug **78** on the side of the unit **17** swings into latching engagement with a latch **79** pivoted on the upper end of the tank **11** and the latch **79** is under the influence of a spring **80** which holds the latch secure with the lug **78**, as seen in FIG. 1. In the raised position of the pump unit **17**, the hose **32** is vertical and can therefore be readily cleaned and flushed with water running therethrough. Also, the tank **11** has a removable cover **81** so that the tank likewise can be readily cleaned.

Further wind-up of the cable **65** will cause the entire assembly of the tank **11** and pump unit **17**, when in the vertical position described, to be raised to the uppermost dot-dash position shown in FIG. 1. In that position, the links **13** and **14** have pivoted upwardly, and link **14** engages a latch **82** which is pivotally mounted on the link **13** and is under the influence of a compression spring **83** so that the latch **82** is self-locking and secure with the link **14**. The unit is then in the transport position.

FIG. 1 shows a valve **84** which it will be understood is connected to the discharge end of the pump assembly **17**, and the dot-dash line shown in FIG. 1 indicates that an extension hose or the like may exist between the unit **17** and the valve **84** which is also shown to be under the influence of a lever type of shut-off for control of the outlet of the concrete.

The pump control station is shown at **85**, in FIGS. 1 and 8, and these controls are connected to the hydraulic pump and reservoir indicated at **86** in FIG. 8, such connection may be of any conventional nature. A hydraulic inlet **87** is connected to a motor control valve **88** and a relief valve **89** and also to a pressure guage **90**. A spring **91** is under the influence of a hand wheel **92** to limit the hydraulic pressure required for delivery of the concrete. When the hydraulic pressure set by the relief mechanism is exceeded, the valve **89** will permit the return of oil to the reservoir and through the connection **93**. The valve **88** has a control lever **94** which is spring returned to its off position which is the center position, and it is lifted to operate the pump in the forward direction. Oil will flow from the valve port **95** to a motor port **96** and then out the motor port **97** to an inlet port **98** which is connected with the plunger charging control valve **99**. Oil may then also go to the drain port **100** and to a port **101** of the valve **88** and to and from a drain **102** to the return connection **93**.

The valve **99** is the charging plunger control valve and is designed to reverse the direction of flow to the operating cylinder whenever the plunger **22** is blocked in its stroke or when pressure rises above a normal amount. The valve **99** is a spool valve biased to the ends of the stroke by a spring detent **103**, of conventional design, and it includes either mechanical or hydraulic over-center means to assure that it cannot stop in mid-stroke. In the pumping stroke for the plunger **22**, oil flows from the valve port **104** and to the cylinder port **105** of the cylinder **28**, and the oil returns from a cylinder port **106** to the valve port **107**. At the end of the stroke, pressure at the port **104** will rise to increase hydraulic pressure against the operating piston section of the valve spool, such as indicated at portion **108** on valve **99** and which may be conventional, to move the valve spool to the opposite end of its stroke. Then, when hydraulic pressure rises, a second operating piston within portion **109** will return the valve to complete the valving cycle. Orifices **110** indicate leakage ports and internal ports which combine to calibrate the piston pressure at which the valve spool reverses.

When the control lever **94** of the valve **88** is moved below its center-off position to operate the pump motor in reverse direction, a check-valve **111** will close to prevent flow from the valve port **101** and into port **100**. Then check-valve **112** will open to permit flow from valve port **101** to motor port **97**, as shown by dotted lines, and then flow continues out of motor port **96** to valve port **95** and then to drain. Check-valve **113** will open to apply motor inlet pressure to the operating portion **108** having the piston, and thus lock the charging plunger in its retracted position.

In normal operation of the pump, the pressure guage **90** will indicate fluctuating pressures below the maximum setting. If the discharge valve **84** is closed, the pump will stop rotating and the gauge will indicate maximum set pressure. The operator will use the gauge and pump rotation to guide him in delivering concrete into the feed tank. If the concrete blocks movement of the rollers **41** along the hose **32**, the pump will stop while the discharge valve is opened, and the gauge will indicate maximum pressure. The operator will then reverse rotation of the pump for a few seconds to reposition the concrete and then resume the pumping operation.

FIG. 9 shows that an optional gauge **120** can be provided to identify the blocked condition without reference to the discharge valve position. Thus the outlet fitting **33** is replaced by a fitting **115** having a recess **116** sealed from contact with the concrete by means of a flexible sleeve **117** extending around the fitting **115** in the interior thereof. The gauge **120** is connected to the recess **116** by a tube indicated at **118** and through a connection **119**. Thus, with hydraulic fluid in the connections and in the recess **116**, any obstruction along the hose **32** will show as a reduced pressure on the gauge **120** to signal the operator.

Finally when the pump is in the transport position, a support member **121** may be provided to extend from the support means **10** and under the tank **11** to hold the entire pump unit upwardly as shown by the dot-dash lines in FIG. 1.

What is claimed is:

1. In a concrete pump of the type having a flexible hose for receiving concrete to be pumped therethrough, and having powered rollers advancing along said hose to squeeze said hose for collapsing it in the pumping process, and having means extending along said hose to engage said hose for placing said hose in its uncollapsed condition when said rollers have passed along said hose to free said hose from squeezing, the improvement comprising said hose being straight throughout the length squeezed by said rollers, straight guide means engaged with said rollers for positioning said rollers through a straight run along said hose in the pumping process, a concrete hopper disposed in concrete feeding position to said hose, a feeder means disposed in said hopper for moving concrete into said hose, and movable connecting means for movably supporting said concrete pump from a concrete mixer vehicle.

2. In a concrete pump of the type having a flexible hose for receiving concrete to be pumped therethrough, and having powered rollers advancing along said hose to squeeze said hose for collapsing it in the pumping process, and having means extending along said hose to engage said hose for placing said hose in its uncollapsed condition when said rollers have passed along said hose to free said hose from squeezing, the improvement comprising said hose being straight throughout the length squeezed by said rollers, straight guide means engaged with said rollers for positioning said rollers through a straight run along said hose in the pumping process, a fluid drive system for powering said concrete pump, and said system including pressure limit means for interrupting the drive power when the pumping force exceeds a limit.

3. In a concrete pump of the type having a flexible hose for receiving concrete to be pumped therethrough, and having powered rollers advancing along said hose to squeeze said hose for collapsing it in the pumping process, and having means extending along said hose to engage said hose for placing said hose in its uncollapsed condition when said rollers have passed along said hose to free said hose from squeezing, the improvement comprising said hose being straight throughout the length squeezed by said rollers, straight guide means engaged with said rollers for positioning said rollers through a straight run along said hose in the pumping process, a concrete hopper disposed in concrete feeding position to said hose, a feeder means disposed in said hopper for moving concrete into said hose, and said feeder means including a reciprocating member for advancing the concrete into said hose, and drive mechanism operatively connected to said reciprocating member for powering the latter.

4. The concrete pump as claimed in claim 3, including sensing means operatively connected to said drive mechanism for detecting excessive resistance of the concrete in feeding the concrete into said hose and to then reduce the length of the stroke of said reciprocating member for relieving the blockage of the concrete.

5. The concrete pump as claimed in claim 3, including lock-out means operatively connected to said drive mechanism for securing said feeder means in a retracted position while said pump may be operated in a non-pumping reverse direction.

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